COOLER WITH BLOWER BETWEEN TWO HEATSINKS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of priority of US Provisional Patent Application serial No. 60/458,099 for Edward Lopatinsky et al. the entire content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates generally to cooling systems. More particularly, the present invention relates to cooling systems for regulating the temperature of electronic components. The present invention is particularly, but not exclusively, useful for a cooling system for regulating the temperature of electronic components of a desktop computer.

[0003] During normal operation, most electronic devices generate significant amounts of heat. If this heat is not continuously removed, the electronic device may overheat, resulting in damage to the device and/or a reduction in operating performance.

[0004] In order to avoid such problems caused by overheating, cooling devices are often used in conjunction with electronic devices.

[0005] One such cooling device used in conjunction with electronic devices is a heatsink. In such device, a heatsink is formed from a material, which readily conducts heat. The heatsink is usually placed on top of, and in physical contact with, the electronic device.

[0006] One method of increasing the cooling capacity of these heatsinks is by including a plurality of cooling fins that are physically connected to the heatsink. These fins serve to increase the surface area of the heatsink and, thus, maximize the transfer of heat from the heatsink to the ambient air. In this manner, the heatsink draws heat away from the electronic device and transfers the heat to the ambient air.

[0007] In order to further enhance the cooling capacity of a heatsink device, an electrically powered blower (an axial fan may serve as the blower) is often mounted within or on top of the heatsink. In operation, the blower forces air to pass over the fins of

the heatsink, thus, cooling the fins by enhancing the heat transfer from the fins into the ambient air. As the fins are cooled, heat can be drawn from the electronic device and into the heatsink at a faster rate. The blower typically draws air into the heatsink from the top of the heatsink, passes the air over the fins, and exhausts the air from the heatsink in the vicinity of the bottom of the heatsink. Accordingly, the exhaust air is hotter than the intake air.

[0008] There are known devices of this type - see, for example, US patent No. 6,152,214 "Cooling device and method". The design of the device comprises an axial fan that produces a flow passing by heat exchanging channels of the heatsink. However, due to the weak airflow in the area adjacent to the axial fan axle, the conditions for cooling of the central part of the heatsink located underneath a hub of the axial fan are unfavorable. In this case non-uniform cooling of the heatsink and electronic device, for example, processor, will take place. Besides, the energy of airflow outgoing from the axial fan impeller in the axial direction is expended because of deceleration and turn in motion before this airflow enters to the heat exchanging channels. This fact decreases the speed of airflow passing by the heat exchanging channels, which, in its turn, doesn't allow obtaining good conditions for the heat exchange process.

[0009] Centrifugal fans are used rarely in the cooling device designs for the purpose of producing airflow.

[0010] Specifically, US patent No. 5,838,066 "Miniaturized cooling fan type heatsink for a semiconductor device" offers a design employing a centrifugal fan that is installed to the side of the heatsink. In one particular embodiment of this invention the cooling airflow passes by rectilinear heat exchanging channels of the heatsink.

[0011] However, placement of centrifugal blower to the side of the heatsink increases device size. In addition, the location of centrifugal blower leads to insufficient coordination between the direction of channel inlets and direction of airflow supplied from the blower. Due to mentioned circumstance hydraulic losses result a reduction of airflow inside heat exchanging channels and decline heat exchange efficiency. A portion of airflow energy is also expended on friction against the casing, in which the blower is enclosed.

[0012] It is the object of the current invention to create such cooler for electronic components that would combine a heatsink and a centrifugal blower that would be capable of significantly improving the thermal efficiency compared to any of the prior art.

SUMMARY OF THE INVENTION

[0013] Accordingly, it is an object of the present invention to provide an apparatus including at least two heatsinks and a centrifugal blower for cooling of electronic components, which is capable of significantly improving cooling performance thereof.

[0014] In order to achieve these objectives, according to the present invention, an apparatus for cooling of electronic components comprises at least two heatsinks thermally connected with each other by heat spreading means, and at least one double inlet centrifugal blower comprising a casing with two inlets and an outlet, an impeller with an axle and an electric drive, said cooler thermally connected with said electronic component.

[0015] Each of said heatsinks comprising inflow and outflow openings, and thermally connected heat exchanging means and a base. Said double inlet centrifugal blower located between said heatsinks thus each of said outflow opening coincide with said closest inlet, so cooling air flows through said inflow openings, said heat exchanging means, said outflow openings and inlets of said blower in a series way.

[0016] In a preferred embodiment the base of at least one said heatsink thermally connected with said electronic component. In this embodiment said heat spreading means is at least one heat pipe comprising evaporator and condenser parts that thermally connected with said bases of two different heatsinks.

[0017] According to the second object of the present invention, said heat spreading means is a high heat conductive plate located from one side of and perpendicularly to said bases. In such configuration, said high heat conductive plate thermally connected with said electronic component and said high heat conductive plate located from one side of and perpendicularly to said bases. In such configuration, said heatsinks and said high heat conductive plate can made as a single whole.

[0018] In either configuration, said heat exchanging means are upstanding pins and/or fins contacting said base.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the cooler for cooling of electronic components according to the preferred embodiment of the present invention;

Fig. 2 is a perspective view showing the a cooler for cooling of electronic components according to the preferred embodiment of the present invention without top heatsink;

Fig. 3 is a perspective view showing the a cooler for cooling of electronic components according to the preferred embodiment of the present invention with half of the top heatsink cutout exposing the heat spreading means;

Fig. 4 is a perspective view showing the a cooler for cooling of electronic components according to the preferred embodiment of the present invention without the top heatsink and centrifugal blower;

Fig. 5 is a perspective view showing the cooler for cooling of electronic components according to the second embodiment without one of the heatsinks exposing the centrifugal blower;

Fig. 6 is a perspective view showing the a cooler for cooling of electronic components according to the second embodiment shown in Fig. 5 without one heatsink;

Fig. 7 is an exploded view of the cooler for cooling of electronic components according to the second embodiment of the present invention shown in Fig. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] Preferred embodiments of the present invention will be described in detail below with reference to the accompanying drawings. The numbering of components is consistent throughout, with the same components having the same number.

[0020] Figures. 1 - 4 show the preferred embodiment of the present invention.

[0021] The cooler 1 for cooling of electronic components (not shown) comprises of at least two heatsinks 2 and 3 thermally connected with each other by heat spreading means 4 and at least one, double inlet centrifugal blower 5 comprising a casing 6 with two inlets 7 and 8, and an outlet 9, an impeller 10 with an axle 11 and an electric drive 12, wherein each of said heatsinks 2 and 3 comprises an inflow openings 13 and outflow openings 14, heat exchanging means 15, and a base 16 providing thermal contact with said heat exchanging means 15. The double inlet centrifugal blower 5 located between said heatsinks thus each of said outflow openings 14 coincide with said closest inlet 7 or 8, so cooling air flows through said inflow openings 13, said heat exchanging means 14, said outflow openings 14 and inlets 7 and 8 of said blower in a series way.

[0022] The base 16 of at least one said heatsink 2 or 3 thermally connected with said electronic components (not shown).

[0023] The heat spreading means 4 is at least one heat pipe 17 comprising of evaporator 18 and condenser parts, to facilitate the heat transfer, said parts thermally connected with bases 15 of two different heatsinks 2 and 3.

[0024] The heat spreading means 4 may further comprise of a high heat conductive plate 20 located from one side of and perpendicular to the bases 16. Furthermore, said high heat conductive plate 20 thermally connected with said electronic components. (Fig. 5 - 7) The heat exchanging means 15 are upstanding pins and/or fins 21 contacting said base 16.

[0025] Both the upstanding fins 21, the base 16 and high heat conductive plate 20 are made from high heat conductive material. It is preferably to made the upstanding fins 21 and the base 16 as a single whole. In this case it is possible to use well-known extrusion technology.

[0026] Further, the heatsinks 2 and 3, and high heat conductive plate 20 can be made as a single whole.

[0027] The electric drive 12 is a flat type motor and comprises the stator 21, a magnetized rotor 22 and a controller 23. The magnetized rotor 22 is combined with the impeller 10.

[0028] The stator 21 is constructed as printed circuit boards 24 that position on the stator plate 25 and use with the controller 23.

[0029] The controller 23 may be a Full Bridge Drive or a Two Phase-Single Ended Drive, for example of type Fairchild NDSSS58H.

[0030] According to the preferred embodiment the magnetized rotor 22 is made of at least one disk 26 rigidly mounted perpendicularly to the axle 11 and connected to the impeller 10. The disk 26 has an outer circumferential array of radial extending unlike and or like magnetized poles 27. The stator 21 comprises of a circumferential array of coils 28 on the circuit boards 24, each coil 28 is wound about an axis parallel to the axle 11 for generating an axially directed electromagnetic field that interacts with magnetic flux lines of each magnetized pole 27.

[0031] The operation and design of the electric drive 12 in the present invention is substantially similar as was described in the US Patent Application No. 10/183,032 for BRUSHLESS DC ELECTRIC MOTOR for the same Assignee, which is hereby incorporated by this reference for all that disclosed therein.

[0032] Thus, rotation of the magnetic rotor 22 of the electric drive 12 due to electro-magnetic interaction causes rotation of the impeller 10 and generates the flow of the air and dissipates heat from heatsinks 2 and 3 to the ambient.